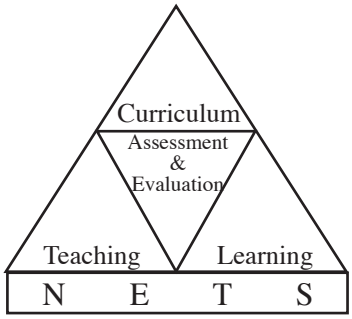
G.C.E.(A.L) Examination - 2016

Marking Scheme

09 - Biology



Research and Development Branch
National Evaluation and Testing Service
Department of Examinations, Sri Lanka

2.1.3 Expected answers and the scheme of marking for paper I

Question No	Answer	Question No	Answer
01.	3	26.	4
02.	2	27.	2
03.	3	28.	2
04.	2	29.	3
05.	1	30.	1
06.	4	31.	4
07.	3	32.	5
08.	3	33.	4
09.	5	34.	4
10.	2	35.	2
11.	2	36.	4
12.	1	37.	2
13.	4	38.	2
14.	1	39.	2
15.	4	40.	2
16.	1	41.	2
17.	4	42.	1
18.	5	43.	5
19.	3	44.	2
20.	2	45.	2
21.	4	46.	5
22.	2	47.	5
23.	4, 5	48.	5
24.	1	49.	2
25.	2	50.	1

Each correct answer carries 02 marks, amounting the total to 100.

2.2 Paper II and information on answers

2.2.1 Structure of the paper II

Allotted time is 03 hours.

This question paper consists of two parts, Structured Essay and Essay.

Part **A** – This contains four structured essay questions. **All** the questions should be answered. Each question carries 100 marks, so the total mark is 400.

Part **B** – This contains **six** essay type questions from which four should be answered. Marks allocated for each question is 150. The total mark is 600.

Total mark for Paper II is 1000 ÷ 10 = 100

2.2.2. Expected answers, marking scheme and observations, conclusions and suggestions related to answers for Paper II.

The observations related to the answers for Paper II have been presented by the graphs 2, 3, **4.1, 4.2 and 4.3.** The relevant portion of the graph is displayed with observations and conclusions for each question.

Part A – Structured Essay

Question 1.

01. (A) (i) What are macromolecules?

- They are (large) molecules with a molecular weight of 10^4 - 10^{10}
- made up of large number of monomer units / polymers **(2 × 2½ marks)**

(ii) Name the three types of macromolecules found in living organisms.

- Polysaccharides
- Proteins
- Nucleic acids **(3 × 2½ marks)**

(iii) Name the disaccharide sugar found in the following and indicate the constituent monosaccharide unit of each of them.

	Disaccharide	Monosaccharide unit
(a) Sugar cane plant	Sucrose	Glucose and Fructose
(b) Germinating seeds	Maltose	Glucose
(c) Milk	Lactose	Glucose and Galactose

(3+3) × 2½ marks)

(iv) What is the monosaccharide unit found in NAD and ATP?

- Ribose **(1 × 2½ marks)**

(v) Lipids are one of the major organic compounds in living organisms. State two important characteristics of lipids which distinguish them from other major biological molecules.

- Insoluble in water / Soluble in organic solvents
- H:O is greater than 2:1 / less oxygen content **(2 × 2½ marks)**

(vi) Name five major types of lipids found in organisms.

- Fats and oils
- Phospholipids
- Terpenes
- Wax
- Steroids

(5 × 2½ marks)

(B) (i) What are mutations?

- Changes occurring in DNA /Genetic material/ Genome of an organism **(1 × 2½ marks)**

(ii) State the significance of mutations in evolution.

- (Beneficial) mutations can produce new variations, leading to more suitable/ or more fitted organism. **(1 × 2½ marks)**

(iii) Some human disorders are inherited as mutations. State three such genetic disorders indicating the type of mutation in each of them.

Disorder	Type of mutation
• Colour blindness	• Gene mutation
• Haemophelia	• Gene mutation
• Albinism	• Gene mutation
• Down's Syndrome	• Chromosomal mutation
• Klinefelter syndrome	• Chromosomal mutation
• Turner's syndrome	• Chromosomal mutation
• Thalassemia	• Gene mutations
• Hungtingdun's disease	• Gene mutations
• Sickle cell anaemia	• Gene mutations
• Cystic fibrosis	• Gene mutations

(3+3) × 2½ marks)

(C) (i) What is Biological Oxygen Demand?

- Amount of dissolved oxygen needed by aerobic microorganisms to breakdown organic (matter in) waste **(1 × 2½ marks)**

(ii) What happens when a large amount of waste with high Biological Oxygen Demand (BOD) is discharged into an aquatic ecosystem?

- Microorganisms consume large amount of oxygen in water for decomposition of waste
- Dissolved oxygen content in water is decreased affecting aquatic organisms

(2 × 2½ marks)

(iii) State two methods used in current waste water treatment plants to reduce Biological Oxygen Demand (BOD) by oxidation of organic matter.

- Trickling filter method
- Activated sludge method **(2 × 2½ marks)**

(iv) Solid waste disposal has caused serious environmental issues in Sri Lanka. What are the adverse effects of open dumping of solid waste on land?

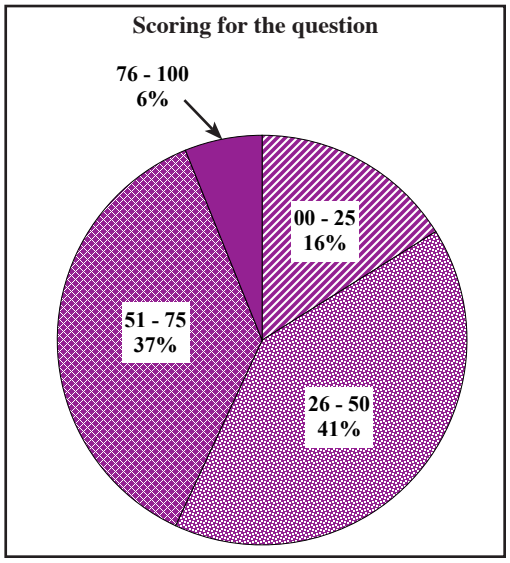
- Develops mosquito breeding grounds
- Produces bad smell due to anaerobic decomposition of waste
- Hazardous/ explosive Methane is produced
- Spreading out of insects/ rodents
- Ground water can be contaminated **(5 × 2½ marks)**

(v) What are the methods that can be used to minimize the issues of disposal of solid waste?

- Separation and recycling
- Decomposition of organic matter/composting
- Sanitary landfills **(3 × 2½ marks)**

(Total 40 × 2½ = 100)

Overall observations, conclusions and suggestions regarding the answers to question 1:



Although this question is compulsory, only 99% of candidates have answered it. Marks allocated for this question is 100. The percentages of candidates scored within four intervals is as following:

In 00 - 25 marks range ⟶ 16%
In 26 - 50 marks range ⟶ 41%
In 51 - 75 marks range ⟶ 37%
In 76 - 100 marks range ⟶ 6%

The percentage of candidates, scored 76 or above is 6% while 16% were in range below 25. 57% of candidates have scored below 50 marks or below 50.

Question 2

02. (A) (i) What is homeostasis?

- Maintenance of constant internal environment **(in the body)** **(1 × 2½ marks)**

(ii) State three factors that are homeostatically regulated in man

- Body temperature
- Blood Glucose
- Blood Oxygen
- Blood carbon dioxide / CO_2
- Blood water content/ osmotic pressure
- Blood pH / H^+
- Blood Na^+ / K^+ / Ca^{+2} / Cl^- / HCO_3^-
- Blood pressure **(3 × 2½ marks)**

(iii) State two advantages of homeostasis in man

- Maintenance of optimum conditions in tissue fluids / maintain optimum metabolic rate / maintain optimum conditions for enzyme activity
- Maintains steady state
- Person becomes active
- Person becomes healthy **(2 × 2½ marks)**

(iv) State one disadvantage of homeostasis in man

- Energy has to be spent / ATP has to be spent **(1 × 2½ marks)**

(v) Human liver plays a variety of roles in homeostssis. State four such roles

- Regulation of blood glucose level
- Regulation of lipid content
- Synthesis of non-essential amino acids
- Detoxification
- Thermoregulation
- Elimination / breakdown of sex hormones
- Brakedown / elimination of haemoglobin
- Storing blood
- Storage of vitamins A, D, E, K / fat soluble vitamins
- Synthesis of blood proteins
- Synthesis of cholesterol
- Production of urea **(any 4 × 2½ marks)**

(vi) Give two examples of positive feedback mechanisms operating in man.

- Parturition / Oxytocin stimulates myometrial contractions and myometrial contraction increases releases of oxytocin further.
- Milk ejection / Suckling of breasts stimulates oxytocin release which causes milk ejection

(2 × 2½ marks)

(B) (i) What is lactation?

- Lactation is the synthesis / production and release / ejection of milk from breasts / mammary glands

(1 × 2½ marks)

(ii) What is the most abundant component in human milk?

- Water

(1 × 2½ marks)

(iii) Name two placental hormones which act on the breasts.

- Oestrogen
- Progesterone
- Human placental lactogen

(2 × 2½ marks)

(iv) Name two components of colostrum

- Water
- Immunoglobulin / Globulin / antibodies
- Fats
- Proteins
- cells of mammary glands

(2 × 2½ marks)

(v) What is the role of oxytocin in lactation?

- Stimulates milk ejection / release

(1 × 2½ marks)

(vi) Name two hormones which inhibit milk production in women.

- Prolacting inhibiting factor / P I H / P I F
- Progesterone

(2 × 2½ marks)

(vii)State three advantages of breast feeding.

- Milk is sterile / less prone to infection
- Milk is correctly warmed
- Ensures optimal growth and development (right components in correct proportion)
- Provides antibodies (passive immunity)
- Facilitates iron absorption
- Facilitates development of facial muscles (which are involved in speech)
- Less prone to allergies
- Facilitates development of intimate contact between mother and infant / baby

(any 3 × 2½ marks)

(C) (i) State the three main functions of the human nervous system.

- Co-ordination
- Integration
- Homeostasis **(3 × 2½ marks)**

(ii) Name two phyla having animals with double ventral nerve cords.

- Annelida
- Arthropoda **(2 × 2½ marks)**

(iii) Name a Phylum having animals with radial nerves.

- Echinodermata **(1 × 2½ marks)**

(iv) State two advantages of nervous regulation over endocrine regulation.

- Quick responses
- Pathway is specific
- Localized responses can be elicited
- Blood system is not required **(any 2 × 2½ marks)**

(v) What is a receptor?

- Specialized organ or structure that detects a stimulus **(1 × 2½ marks)**

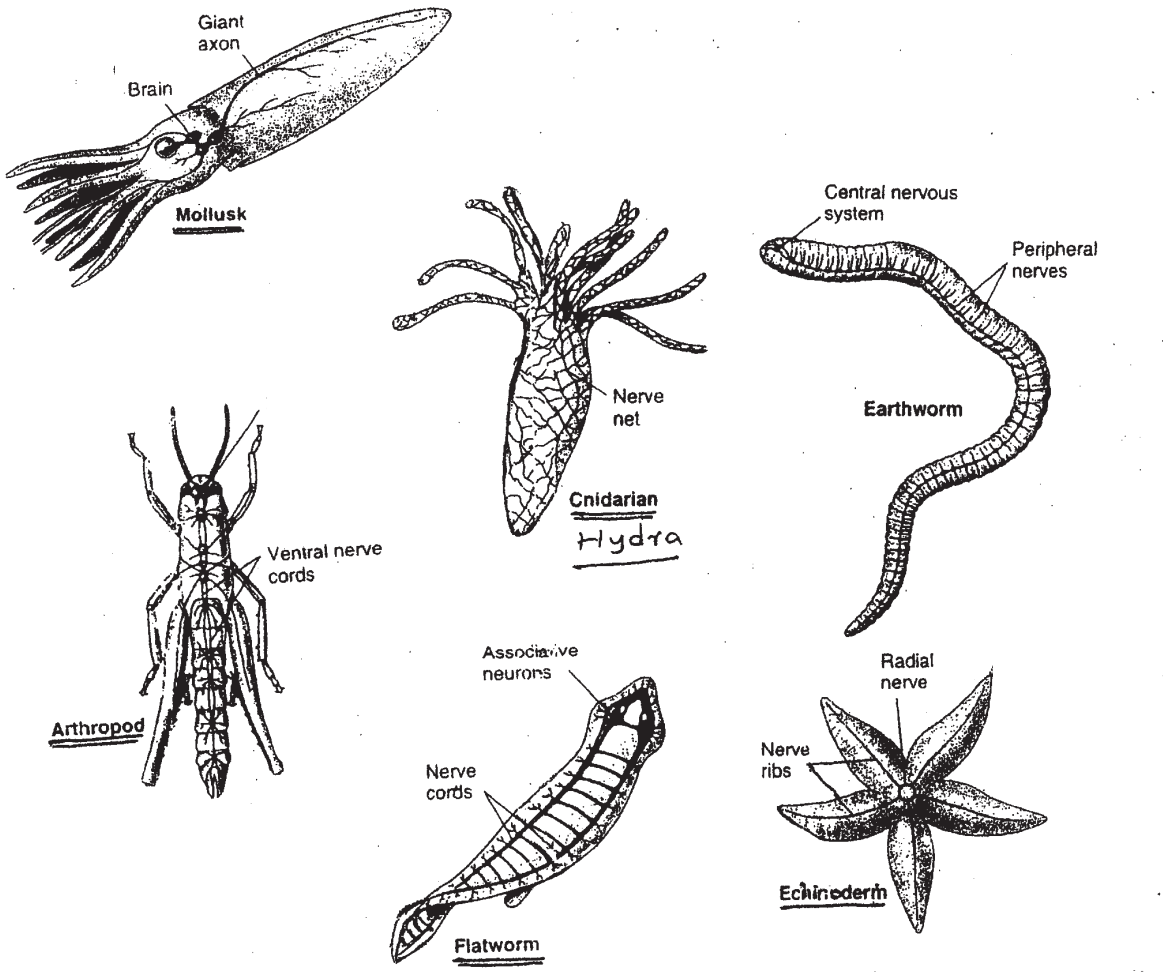
(vi) State three features of receptors.

- Designed to receive specific stimuli
- Acts as transducers
- Consists of specialized cells
- Connected to nervous system
- Shows adaptations
- Respond to a minimum threshold level **(2 × 2½ marks)**

(vii) Name three receptors sensitive to touch.

- Meissner's corpuscles
- Merkel's discs
- Free nerve ending **(any 3 × 2½ marks)**

(Total 40 × 2½ = 100)



2 (C) (iv), (v), (vi) and (vii) sub parts possess facilities of 36%, 35%, 43% and 58%. All of these a sub parts were knowledge based and included in cognitive domain. Most of the candidates were failed to present the subject mater and concepts in correct manner.

Question 3

03. (A) (i) Some external features of five invertebrates labeled as A, B, C, D and E are as follows.

A – Flattened, bilaterally symmetrical body with eye spots

B – Cylindrical radially symmetrical body with a mouth surrounded by tentacles

C – Cylindrical , bilaterally symmetrical body with numerous setae and without a clitellum

D – Cylindrical , bilaterally symmetrical body with a clitellum

E – Umbrella shaped radially symmetrical body with many tentacles around its edge

Complete the following dichotomous key using correct numbers and the letters A, B, C, D and E

1. Bilaterally symmetrical body	———	**2**
Radially symmetrical body	———	**3**
2. Flattened body	———	**A**
Cylindrical body	———	**4**
3. Tentacles around the edge of the body	———	**E**
Tentacles around the mouth	———	**B**
4. Clitellum present	———	**D**
Clitellum absent	———	**C**

(8 × 2½ marks)

(ii) State the class of each the animals labeled as A, B, C, D and E

- ***A*** - Turbellaria
- ***B*** - Anthozoa/ Hydrozoa
- ***C*** - Polychaeta
- ***D*** - Oligochaeta
- ***E*** - Scyphozoa **(5 × 2½ marks)**

(B) (i) Name the parts that can be seen in a longitudinal section of a mature unfertilized ovule of an angiosperm

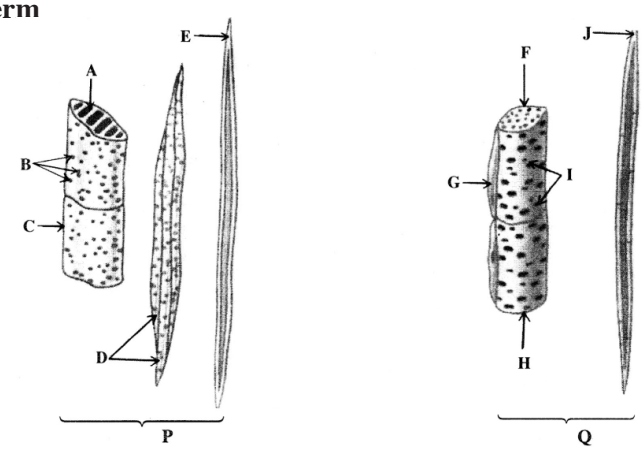
- Chalaza
- Nucellus
- Integument
- Antipodal nucleus
- Micropyle
- Embryo sac
- Polar nuclei / Secondary nucleus
- Egg cell / ovum
- synergids
- Hilum / Funiculus **(10 × 2½ marks)**

(ii) List the post fertilization changes that take place in the major structures of the angiosperm ovary

- Zygote develops into embryo
- Endosperm nucleus develops into endosperm
- Integuments develop into seed coat
- Ovule develops into seed
- Ovary develops into fruit

(5 × 2½ marks)

(C) The diagram P and Q given below show some constituent elements of the two vascular tissues in angiosperm



(i) Identify the two vascular tissues shown in the diagram

- P = Xylem
- Q = Phloem

(2 × 2½ marks)

(ii) Name the constituent elements indicated with arrows

- **A** = Perforation plate
- **B** = Pits
- **C** = Vessel element/ vessel
- **D** = Trachieds
- **E** = (Xylem) fiber
- **F** = Sieve plate
- **G** = Companion cell
- **H** = Sieve tube element
- **I** = Sieve area
- **J** = (Phloem) fibers

(10 × 2½ marks)

(Total 40 × 2½ = 100)

3 (A) the facility was 69%. The ability of categorizing organisms according to a dichotomous key had been evaluated in this sub part.

In classifying organisms based on a dichotomous key;

- ⋆ Only external features of organisms should taken into consideration
- ⋆ each step should be given two alternative statements.
- ⋆ The organism explained by the statement should be mentioned in front of each
- ⋆ or the number of next step which guides to identify organisms should be mentioned.
- ⋆ There are some features should not mention in the preparation of a dichotomous key.

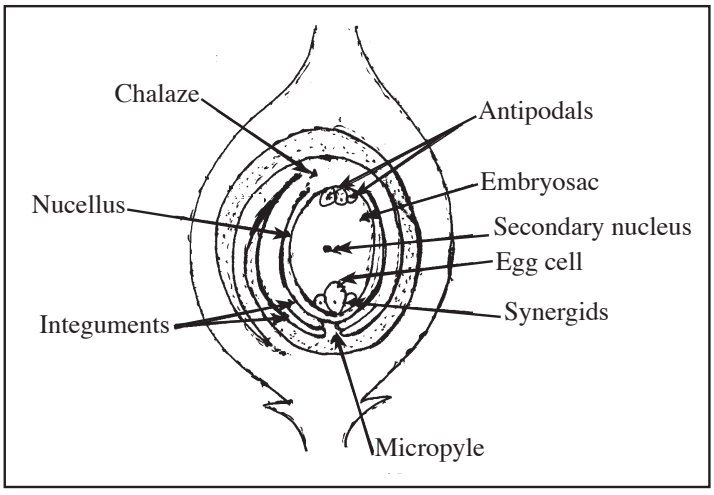
eg:-
- The body colour of organism (may alter according to sexuality)
- The body size (may alter according to sexualicity and maturity)
- Habital

Candidates should possess skills to prepare dichotomous keys based on above criteria.

3 (A) (ii) sub parts has a facility of 46%. Identification of animal class according to external features was evaluated in this sub part. The features of animal phyla and classes mentioned in the teacher's manual also should be studied well for this question.

3 (B) (i) and (ii) sub parts possessed a facility of 29% and 28% respectively. The ability of the candidate to differentiate the parts of a matured ovule of an Anthophyte seed has been examined in this part.

Following is a vertical section diagram of an Anthophyte ovule.



(C) (i) and (ii) sub parts had a facility of 71% and 40% respectively. In these sub parts, identification and naming the Anthophytic complex tissue had to be done. Though most candidates named the two basic tissues, they were unable to answer (C) (ii) sub part in which the ability to identify the detail structural features were measured.

Question 4

04. (A) (i) What is an ecosystem?

- Functional / dynamic unit
- comprising of all living organisms in a community and the abiotic environment that interacts with them **(2 × 2½ marks)**

(ii) What are the major biotic components of an ecosystem?

- Primary producers
- Consumers
- Detritivores / decomposers **(3 × 2½ marks)**

(iii) How are the biotic components of an ecosystem connected with each other?

- Through feeding
- and energy transfer **(2 × 2½ marks)**

(iv) Define "ecological niche"

- Role of an organism in the ecosystem / environment **(1 × 2½ marks)**

(v) (a) What is meant by gross primary productivity of an ecosystem?

- Total amount of light energy converted to chemical energy by primary producers within a unit area, within a unit time/per unit time

(1 × 2½ marks)

(b) State the main primary producer of each of the following ecosystem

Ocean	**Phytoplankton**
• Villu	Grass
• Patana	Grass

(3 × 2½ marks)

(B) (i) Explain what is a biome?

- Widely spread,
- major ecosystems of the world
- classified according to predominant vegetation
- and characterized by regional climatic conditions
- and adaptations of organisms to that particular environment **(5 × 2½ marks)**

(ii) What are the three main terrestrial biomes in the tropics?

- Tropical forests
- Deserts
- Savanna **(3 × 2½ marks)**

(iii) What is the largest terrestrial biome?

- Taiga / Coniferous forests **(1 × 2½ marks)**

(iv) What is a keystone species?

- A species that plays an important role in the stability
- and functioning of an ecosystem.
- If removed system may collapse **(3 × 2½ marks)**

(v) Explain the concept of flagship species.

- Publicity is given to few key species which will help to conserve the entire ecosystem (and organisms contained in it **(1 × 2½ marks)**

(C) (i) What is global warming?

- Increase of average temperature of the atmosphere **(1 × 2½ marks)**

(ii) (a) Name five atmospheric gases that contribute to global warming.

- Carbon dioxide / CO_2
- Oxides of nitrogen / N_2O / NO_2 / NO / NO_x
- Methane / CH_4
- Water vapor
- Ozone / O_3 **(5 × 2½ marks)**

(b) Explain how the gases stated in (a) above contribute to global warming.

- Prevent part of the solar radiation that reaches earth surface being radiated back (to the space) **(1 × 2½ marks)**

(iii) Explain what is an invasive species.

- Non- native species which can spread beyond its introduction site
- and become established in new sites
- where it may cause deleterious effects on local biodiversity. **(3 × 2½ marks)**

(iv) Explain how agriculture contribute to biodiversity loss

- Use of few species/varieties (of plants and animals),
- displacement of traditional varieties/breeds/ species
- result in genetic erosion / loss of genetic diversity/ loss of genetic resources
- Habitat loss
- resulting in loss of ecosystem diversity **(5 × 2½ marks)**

(Total 40 × 2½ = 100)

4 (A) (i), (ii), (iii) and (iv) sub parts possessed a facility of 28%, 38%, 13% and 59%. Specific facts regarding ecosystems and their components were asked which were knowledge based in these questions.

Though these questions were easy, most candidates avoided answering, hence the overall facility of those were low. The reason to this condition is low attention of candidates to last few units of the syllabus.

4 (A) (v) (a) and (b) sub parts also possessed a low facility as 19% and 29% respectively. According to the way of asked, the primary producers of different ecosystems are different from each other.

Example :-	Ocean	-	Phytoplanktons
	Villus and Pathana	-	grasses
	Forests	-	green plants
	Shallow pond	-	aquatic plants

(B) (i), (ii) and (iii) sub parts had a facility of 25%, 30% and 44%. Defining the "biome", and major biomes of world were asked in these questions.

When name the major biomes of the tropical region it had mentioned as "tropical forests", "deserts" and "savana". They couldn't score in these questions because "tropical rain forests" was mentioned instead of "forests". The largest terrestrial biome of the world is Taiga or coniferous forests. It is a temperate biome. Due to heavy snow in winter they have gained a cone shaped crown to prevent accumulation of snow as an adaptation. Hence conifers have become dominant in this biome.

(B) (iv) and (v) questions possessed a facility of 15% and 18% respectively. The knowledge of students was examined regarding keystone species and flagship species to indicate the environmental significance. This ensured that the knowledge of candidates was low about specific environmental concepts. Instead on explaining the flagship species concept, candidates had defined it.

(C) (i) and (ii) (a) and (b) sub parts possessed a facility of 23%, 49% and 17% respectively. "Global warming" means "rise of normal atmospheric temperature". In this question candidates had used terms such as "earth sphere"/ "earth" instead of the "atmosphere" and they hadn't mentioned "normal" which was the reason not to gain marks.

Some students were failed to state the types of gases contributes in global warming as mentioned in teacher manual.

(C) (iii) and (iv) sub parts had facility as 10% and 7%. Most candidates were failed to define "invasive species" in correct manner.

They were not able to score in (iv) question in which the contribution of agriculture in loss of Biodiversity was asked, because they hadn't a proper understanding about it.

According to above facts the 4th question had a low facility in which questions were given from the environmental biology unit.

Part B - Essay

Question 5

5. *(a)* Describe the basic chemical nature and general structure of proteins.

Chemical nature

1. Proteins are complex organic compounds.
2. Contain elements C, H, O, N, and S.
3. Macromolecules/ molecules with high molecular weight.
4. Polymers of amino acids.
5. Peptide bonds connect amino acids,
6. forming polypeptide chains.
7. Around 20 amino acids are involved in making proteins.
8. Some proteins form complexes with metal ions Cu/ Iron/ Zn.
9. Different proteins have different sequences of amino acids / Each protein has a specific sequence of amino acids.
10. The sequence of amino acids in a protein is genetically controlled by the DNA (of the cell which it is manufactured) / determined by the base sequence of the DNA strand (which produces the corresponding m-RNA.)
11. The sequence of amino acids in a protein determines its (biological) function.

General Structure

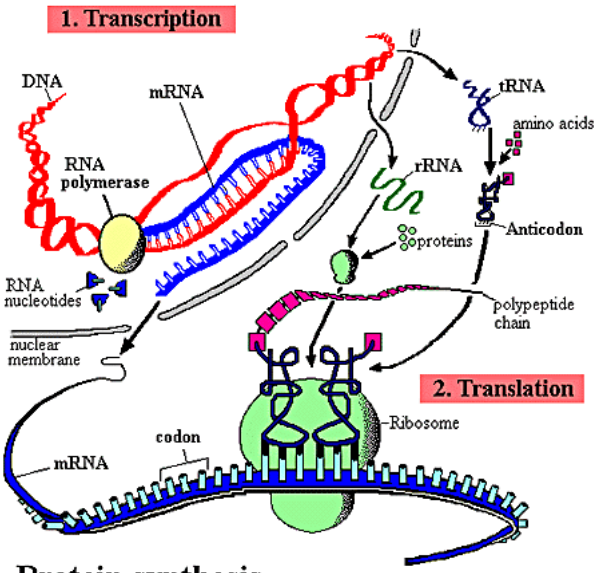
Described in 4 stages / 4 levels of organizations

12. Primary structure
13. Linear sequence of amino acids held together by peptide bonds / in a polypeptide chain.
14. Secondary structure
15. Spiral / Helical (α -helix) structure
16. formed by hydrogen bonds
17. between adjacent COOH and NH_2 groups of amino acids.
18. ex. Keratin
19. Pleated sheet structure / β pleated structure
20. Ex. Silk protein
21. Tertiary structure
22. Formed by bending and folding of polypeptide chains.
23. Produce globular shape / structure.
24. Stabilized by many types of bonds / ionic / hydrogen / disulfide bonds.

25. Quaternary structure
26. Globular structure
27. Formed by the aggregation of several polypeptide chains
28. by interaction of hydrogen and ionic bonds.
29. Ex. Haemoglobin

***(b)* Briefly discuss the specific roles of DNA and RNA in protein synthesis**

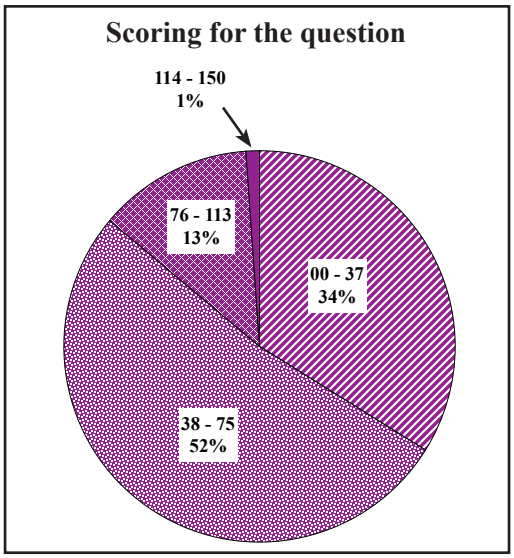
30. DNA carries the genetic information for synthesis of proteins
31. in the form of coded instruction in the (nucleotide) base sequence.
32. Double helix of DNA molecule opens up and
33. acts as a template
34. for the synthesis of m-RNA,
35. which contains (coded / triplet) instructions for synthesis of protein.
36. This is called transcription.
37. It is catalyzed by RNA - polymerase.
38. m-RNA moves in to the cytoplasm and attach to ribosome/ forms polyribosome.
39. Other types of RNA/ t-RNA, r-RNA, synthesized in the nucleus
40. move out in to the cytoplasm.
41. r-RNA reads the m-RNA/ helps to assemble the amino acids/ polypeptide with amino acids.
42. t-RNA brings amino acids to the ribosome/ small unit of the ribosome.
43. Each t- RNA carries a specific amino acid.
44. Ribosome moves along m-RNA,
45. translates the coded massage in the triplet base in mRNA
46. in to a specific sequence of amino acids brought by t-RNA
47. recognized by the anticodon of t-RNA.
48. m-RNA contains a triplet code (AUG) for methionine
49. which functions as a starter/ start codon.
50. Several other codons (UAA, UAG. UGA) act as terminator/stop codon for ending protein synthesis.



Protein synthesis

(50 × 3 = 150)

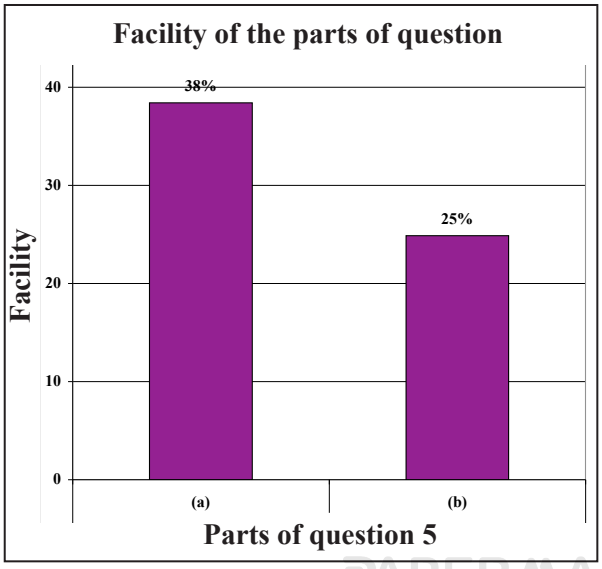
Overall observations, conclusions, and suggestions regarding the answers to question 5:



78% of candidates had answered 5th question. Allocated marks for question 5 was 150. Following percentages of candidates had scored within four intervals are:

In	00	-	37	marks range	⟶	34%
In	38	-	75	marks range	⟶	52%
In	75	-	113	marks range	⟶	13%
In	114	-	150	marks range	⟶	1%

14% of candidates had scored 76 marks or above.
86% of candidates has scored 75 marks or less.



⋆ Two sub parts were included in this question and the facility of both parts were bellow 40%. The sub parts possess higher facility was part *(a)* in which facility was 38% part *(b)* possessed a lesser facility of 25%.

5th question consist of two sub parts as *(a)* and *(b)*. The facility was 38% for part *(a)* in which the basic chemical nature and general structure of proteins had to be described. Part *(b)* asked to discuss briefly, the specific roles of DNA and RNA in protein synthesis and it has a facility of 25%.

The percentage of students scored than 50% in this question was 14%. Highest marks range was between 50 - 60 for this question.

In sub part *(a)* - some common weaknesses could be identified.

- No use of correct terms
- Terms such as primary proteins secondary proteins etc. had been used instead of primary structure, secondary structure as organizational levels of proteins by most candidates.
- They had not used correct examples for proteins.
  - examples for helical and pleted proteins were mentioned being exchanged.
- Most candidates had not understand that some protein make complexes with mineral ions when describe the chemical nature of proteins.

In sub part *(b)* - the role of DNA and RNA in protein synthesis had to describe. Providing incomplete answers caused to low facility. Very important facts included in marking scheme were missed by them and incorrectly compared answers were given. That was a common weakness.

- Though AUG was written as initial cadon, representation of methionine by it was not mentioned.
- It seems that most candidates haven't gained a proper understanding about reaching of all RNA types to the cytoplasm being synthesized within the nucleus.

Question 6

6. *(a)* Describe the location of the human kidney.

1. In the abdominal cavity,
2. close to posterior wall,
3. below the diaphragm,
4. rectoperitonial (cavity)
5. on either side of the vertebral column,
6. between thoracic and lumber vertebrae.
7. Left kidney slightly above the right kidney.

***(b)* Briefly describe the microscopic structure of a typical human nephron.**

8. Tubule closed at one end and opened at other end.
9. Single layered.

Consists of

10. Bowman's capsule
11. Proximal convoluted tubule
12. Descending limb of loop of Henle
13. Ascending limb of loop of Henle
14. Distal convoluted tubule
15. Bowman's capsule is cup shaped and
16. consists of inner wall
17. made up of Specialized cells/ Podocytes and
18. outer wall
19. made up of squamous epithelial cells and
20. capsular space.
21. Proximal convoluted tubule is (Irregularly) coiled;
22. Made up of cuboidal epithelial cells
23. with (many) microvilli / projection / brush boarder
24. facing the lumen.
25. Descending limb of loop of Henle is straight;
26. Made up of squamous epithelial cells.
27. Ascending limb of loop of Henle is straight;
28. Made up of cuboidal epithelial cells.
29. Distal convoluted tubule is (Irregularly) coiled;
30. Made up of cuboidal epithelial cells
31. with (few) microvilli / projection / brush boarder
32. facing the lumen.

(c) **Briefly explain how human kidney regulates blood osmatic pressure**

33. When osmotic pressure is increased
34. it is sensed by Osmoreseptors
35. in the Hypothalamus
36. which stimulates posterior pituitary
37. to release ADH.
38. ADH acts on Distal convoluted tubule and
39. collecting duct
40. making them permeable to water;
41. Results in reabsorption of water
42. producing hypertonic/ concentrated urine.
43. Osmotic pressure restored to normal level.
44. Mechanism stops/ negative feed back mechanism.
45. When osmotic pressure falls
46. no stimulations of osmoreseptors;
47. No release of ADH;
48. No reabsorption of water in
49. distal convoluted tubule and
50. collecting duct;
51. Produce hypotonic/ dilute urine.
52. Osmotic pressure restored to normal level.

(Any 50 × 3 = 150 marks)

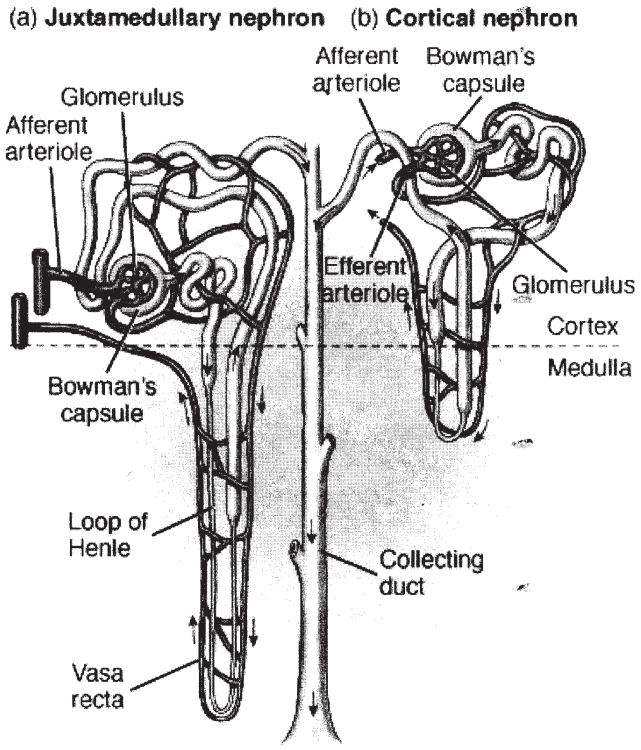
26% of candidates scored higher than 76% in this question.

(a) facility of this sub part was 59%. Though this was the easiest part, due to carelessness of candidates in using terms less achievement level could be seen.

(b) the facility of this sub part was 45%. Few reasons for this low facility could be identified. Facts that should be understood by students are;

- A nephrone is a tubule having opened and closed ends.
- Presence of podocytes on the inner wall of bowman's capsule
- Bowmen's capsule as a hollow structure.
- Presence of micro villi on the cuboidal cells of distal convoluted tubule also.

(c) the facility of this part was 22%. Due to wrong answer about the activity of ADH the facility index was low. Writing "increase the permeability to water" instead of "ADH acts on distal convoluted tubule and collecting duct and make them permeable to water" was one example. Most of the candidates had not mention that the "action of ADH is a negative feed back mechanism". They had presented facts regarding increase and decrease of osmotic pressure being interchanged.



Question 7

7. (*a*) Describe Briefly the nature and distribution of microorganisms in soil.

1. bacteria
2. fungi
3. algae
4. virus
5. They belong to different genera/ species.
6. Soil provides a suitable chemical environment and
7. a suitable physical environment (for microbial growth.)
8. The number of microorganisms present depends on the soil environment.
9. In the fertile soil bacteria dominates soil microorganisms.
10. Microorganisms use minerals/ mineral nutrients,
11. (decomposing) organic material,
12. gases CO_2 / O_2 / N_2
13. Water in soil for their growth.
14. More microorganisms are found on surface layers of soil / deeper layers contains less microorganisms
15. due to availability of oxygen.

any 13 × 4 = 52 marks

Maximum 50 marks

***(b)* Discuss the specific role of microorganisms in the natural cycling of carbon and nitrogen in the biosphere.**

In the natural carbon cycle element carbon is cycled in different forms in the environment through living organisms.

1. CO_2 in the environment (aquatic and terrestrial) is fixed
2. by chemoautotrophic/ photosynthetic bacteria
3. such as cyanobacteria and
4. Algae
5. by / photosynthesis
6. Dead plant and animal bodies are decomposed by heterotrophic bacteria
7. and fungi
8. and CO_2 is released (to the environment)
9. through respiration of microorganisms.

In the natural cycle of nitrogen, element nitrogen is cycled in different forms trough atmosphere, living organisms aquatic and terrestrial environments.

10. soil microorganisms
11. such as *Azotobactor* and
12. *Rhizobium*
13. fix (gaseous) nitrogen
14. in to nitrogenous compounds / protein / NH_4^+
15. Decomposition of protein/ organic matter in dead organisms.
16. by heterotrophic microorganisms/ bacteria and fungi
17. produce amino acids (proteolysis) which
18. are converted to NH_4^+ (ammonification)
19. Ammonium ions are then converted to nitrite
20. by *Nitrosomonas*.
21. Nitrite is converted to nitrate
22. by *Nitrobactor*.
23. *some nitrates are converted to gaseous nitrogen*
24. by denitrifying bacteria/ *Pseudomonas sp*.

any 20 × 4 = 80 marks

(c) **State the significances of interactions of soil microorganisms relevant to plat growth.**

1. Microorganisms are involved in the formation of soil aggregates
2. Symbiotic nitrogen fixation.
3. Mycrorhiza association between roots and fungi improve phosphate nutrition
4. Root surface (rhizosphere) microorganisms produce growth promoting substances and
5. chemicals that inhibit the growth of plant pathogenic bacteria

any 05 × 4 = 20 marks

Though 68% of candidates had selected this question, facility is low because candidates hadn't a perfect understanding about the facts of question.

(a) part possesses a facility of 31%. Because of candidates could not understand properly about the nature of micro-organisms some facts were missed in their answers. Most candidates mentioned the names of organisms only. But when microbes are explained;

- ⋆ The chemical and physical nature of the habitats of them.
- ⋆ The factors cause to the abundancy of them.

example :- candidates were failed to state about mineral nutrients. Organic matter, CO_2 , N_2 , O_2 depth of soil

(b) the facility was 45%. Due to errors in writing the scientific names of micro-organisms facility index was low. Most candidates presented carbon and nitrogen cycles using flow diagrams only. Candidates should understand that is not the correct way of answering an essay question.

(c) the facility of this part is 43%. Though candidates wrote the significances of interactions asked, they hadn't mention about the interactions between microbes and plants.

example :- though they wrote as "N_2 fixation" it was not written as "symbiotic N_2 fixation" which was the expected answers. It caused a low facility index.

Question 8

8. (*a*) What are the general characteristics of plant growth substance?

1. Organic compounds/chemicals
2. that act in small concentrations.
3. and affect / stimulate physiological processes of plants. ***3 × 04 = 12 marks***

(b) **State the major types of plant growth substance and sites of their production in plants.**

1. Auxins
2. Stem apices / apical meristem
3. Young leaves
4. Gibberellins
5. Root / Shoot tips
6. Young leaves
7. Germinating seeds
8. Cytokinins
9. Root apices / apical meristem
10. dividing cells of many tissues
11. Ethelene
12. Parenchyma cells of tissues
13. (Ripening) fruits

14. Abscisic Acid
15. Root caps
16. Immature seeds *16 × 04 = 64 marks*

(c) **Explain how natural growth substance regulate growth and development of plants.**

Auxins

1. Elongation of cells
2. Maintain apical dominance
3. Regulate trophic movements
4. Induce cambial activity
5. Inhibit leaf abscission
6. Induce root growth
7. Induce growth of fruit

Cytokinins

8. Stimulate/ induce cell division (interacting with Auxin)
9. Promote shoot growth
10. Inhibit apical dominance
11. Delay leaf senescence (Aging)

Gibberellins

12. (Promote) elongation of stem
13. Activate enzymes in seed germination

Abscisic Acid

14. Inhibits seed germination / (control) seed dormancy
15. Closure of stomata
16. Inhibition of bud growth
17. Inhibition of cambial activity of plants (in temperate countries)

Ethylene

18. Helps in stem elongation
19. Induces ripening of fruit
20. Induces flowering (in some plants)
21. Controls abscission of leaves /flowers/ fruits *any 19 × 04 = 76 marks*

12 + 64 + 76 = 152 marks

Maximum 150 marks

This was a knowledge based question. 59% of candidates had answered this question. 37% of candidates scored than 76 marks 37% of candidates scored between 38 - 75 marks.

(a) the facility is 35%. The reason was inability of candidates to express the general features of plant growth substances correctly.

(b) the facility of this part was 59%. The content given in teachers manual is sufficient regarding this part. Therefore, the facility index would be higher than this value if candidates could confirm subject matter properly.

(c) the facility of this part was 39%. Inability of candidates to mention the correct term in correct place when writing the actions of plant growth sunstances low facility was given. And they were failed to compare the action of each growth substance properly.

example :- Instead of "Induction of root growth", "Stimulation of root growth" was mentioned

Question 9

9. *(a)* What are the for main forest ecosystems in Sri Lanka?

1. Tropical rain forests
2. Dry mixed evergreen forests
3. Montain forests
4. Thorn forests / shrubs

(b) **Describe the main features of each of these ecosystems with reference to their distribution, rainfall and characteristics of vegetation.**

Tropical rain forests

5. Present in the South – Western region
6. Low to mid elevation/ sea level to 1200m
7. Rainfall 2500-5000 mm per Year (or more)
8. Rainfall throughout the year
9. Very high rainfall in May to August and November - December
10. Stratification
11. Emergent trees
12. Canopy
13. Sub canopy
14. Shrubs
15. Herbaceous Plants

16. Plants evergreen
17. Epiphytes
18. Woody climbers/ Lianas are present
19. High endemism

Dry mixed evergreen forests

20. Present in the Dry Zone
21. Rainfall 1250 – 1900 mm/year
22. Dry period from May to August
23. No (marked) stratification
24. Trees
25. Shrubs
26. Ground layer / grasses and
27. Climbers (frequent) are present

Montain forests

28. In the central massif / high elevation
29. Rainfall 2500- 4000 mm per year / more than 4000 mm per year
30. Trees short
31. with twisted trunks
32. gnarled and
33. covered with lichens / mosses.

Thorn forests

34. In Arid zone
35. In the North West and
36. South - East regions
37. Rainfall <1250 mm / year
38. Drought period from May to September
39. Thorny shrubs
40. with xerophytic characters / fleshy leaves
41. Some trees present
42. which are stunted

any 38 × 04 = 152 marks

Maximum 150 marks

This question consists of two sub parts as (a) and (b). Only 31% of candidates had selected this sub part.

This question was based on the unit "Environmental Biology", one of last units of the syllabus. The cause to low selection might be incomplete coverage of the syllabus.

(a) the facility was 52%. Because of candidates did not write the names of forest in correct manner, a low facility was given.

example :- writing "monsoon forest" instead of dry mixed evergreen forests".

(b) the facility was 19%. Candidates were unable to score because they hadn't mention the forest type had not given other information correctly. They hadn't mentioned;

- ⋆ values of rainfall
- ⋆ period of gaining rain
- ⋆ areas related in correct manner.

Question 10

10. Write short notes on the following

(a) **Human pancreas**

1. Located in the abdominal cavity
2. in the curve of duodenum.
3. Consists of head , body and (narrow) tail.
4. Both exocrine and endocrine gland;
5. exocrine part made up of lobules;
6. each lobule is formed of number of small alveoli
7. consisting of acini cells/ secretory cells,
8. which secretes pancreatic juice,
9. consisting of water,
10. mineral salts and
11. enzymes.
12. Enzymes are amylase
13. lipase,
14. trypsinogen /trypsin
15. chymotrypsinogen/ chymotrypsin
16. nucleases and

17. carboxypeptidase/peptidase.
18. Lobules are drained by small ducts
19. which unite to form pancreatic duct.
20. Endocrine part is the Islets of Langerhans
21. formed of α and β cells.
22. α cells secrete glucogan.
23. β cells secrete insulin.

(b) Biodiversity hotspots

24. The areas with high concentration of endemic species
25. facing exceptional/ high levels of threats/ under threats.
26. There are 25 biodiversity hotspots in the world
27. eg: Western Ghats of India and
28. (fragmented) rain forests of southwest of Sri Lanka

(c) Mechanism of stomatal closure and opening

29. Starch sugar conversion hypothesis
30. During photosynthesis
31. CO_2 concentration decrease in guard cells
32. raising pH in guard cells.
33. Hydrolysis of starch to sugar (by enzymes)
34. increase solute potential and
35. decrease water potential in guard cells.
36. Water enters in to guard cells
37. from surrounding epidermal cells
38. by osmosis.
39. Increase in turgor causes opening of stomata.
40. At night reverse action occurs and close stomata.
41. K^+ intake /K^+ influx hypothesis
42. In the presence of light
43. active intake of K^+ into guard cells.
44. increases solute potential and
45. decreases water potential in guard cells.
46. Water enters in to guard cells (from surrounding epidermal cells)
47. by osmosis.
48. Increase in turgor causes opening of stomata.

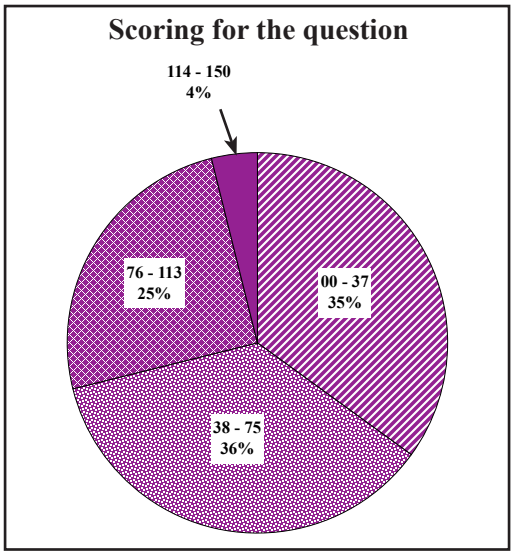
49. Exit of K^+ from guard cells at night closes stomata.

50. Closure of stomata under water stress condition.

51. Occurs due to Abscisic acid

any 50 × 3 = 150 marks

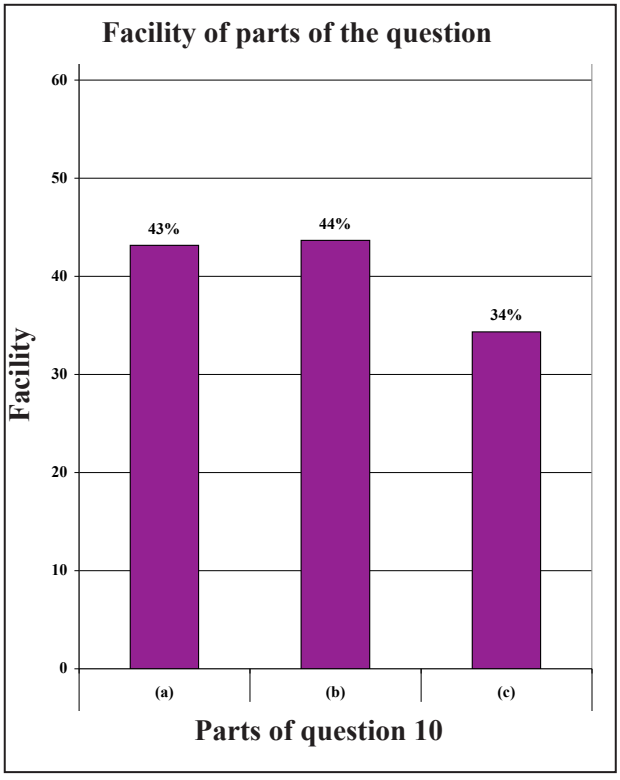
Overall observations, conclusions and suggestions regarding the answers to question 10 :



62% of candidates had answered 10th question. Allocated marks for this question was 150. Percentage of candidates scored within four intervals were as following:

In	00	-	37	marks range	⟶	35%
In	38	-	75	marks range	⟶	36%
In	75	-	113	marks range	⟶	25%
In	114	-	150	marks range	⟶	4%

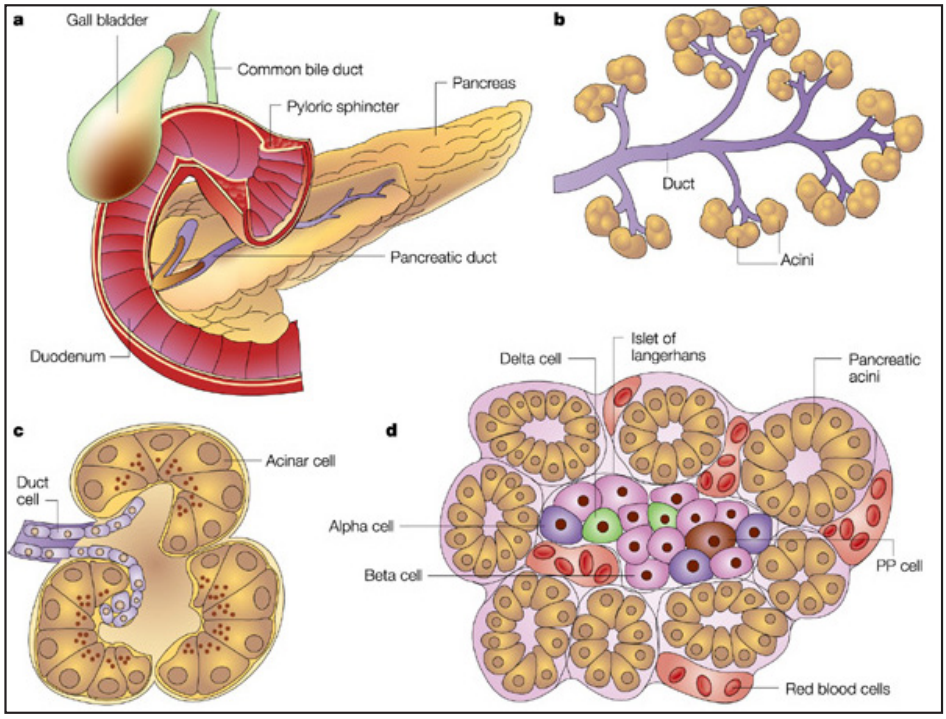
29% of candidates scored 76 marks or more; 36% of candidates scored between 38 - 75 marks.



★ Three sub parts were included in this question. Sub part *(b)* possessed a facility of 44% which was the highest. The lest facility was 34% which of the sub part *(c)*.

This question was selected by 62% of candidates 29% of candidates scored 76 marks or more. 36% of candidates scored between 38 - 75. Those who selected this question as their last question, they could not able to answer properly due to poor time management.

The facility of part (a) was 43%. Though location of pancreas was mentioned correctly, the structure was not explained properly. Candidates were failed to write all ingredients of pancreatic juice. It caused to low facility.



(b) the facility of this part is 44%. Candidates were unable to score because they didn't give answers according to the syllabus.

(c) the facility of this part is 34%. Some candidates didn't explain this mechanism orderly. It caused to low facility of this part. Students should understand that the sequential order is important when explain a mechanism.

Part III

3. Factors to be considered when answering questions and suggestions:

3.1 Factors to be considered when answering :

Common instructions:

- Basic instructions of the paper should be read and understood well. Attention should be given to the number of questions that must be answered from each part, what the compulsory questions are, allocated time for the paper and the questions should be read well to have a clear understanding before selecting the questions to answer.
- Index number of the candidate should be written on each page on the relevant place.
- Write the number of the questions and sub-numbers correctly.
- Depending on the way the question is asked, facts should be presented logically and analytically.
- When a definite short answer is to write, one should not include lengthy details and similarly, when detailed descriptions are to be given, one should not provide short answers.
- One should write answers with correct and clear hand writing
- When answering questions in Paper I, one answer which is more appropriate or correct should be selected and it should be marked with clearly on the answer sheet using one cross (X mark).
- In paper II, Part A, when answering the questions in structured essay paper, it is necessary to make sure that all 4 questions are answered with proper time management. Each sub-parts coming under main question should be read well and only the relevant, targeted answer for each sub-part should be written.
- In Paper II, Part B - when answering essay question paper, it is necessary to make sure that the required number of questions only are answered with correct management of time allocated for Part B.
- In Paper II, when answering the questions of Part B, answers written for each main question should be started in a new page.
- Answers should be written either in blue or black color; other colors should not be used to write answers.